

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of:

Pai-Hung Pan

Serial No.: 09/944,506

Filed: August 30, 2001

For: SHALLOW TRENCH ISOLATION
STRUCTURE WITHOUT CORNER
EXPOSURE (as amended)

Confirmation No.: 4348

Examiner: G. Fourson III

Group Art Unit: 2823

Attorney Docket No.: 2269-2919.5US
(96-0499.02/US)

**VIA ELECTRONIC FILING
May 29, 2007**

REPLY BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attn: Board of Patent Appeals and Interferences

Sirs:

This Reply Brief is being filed in the format required by 37 C.F.R. § 41.41. As May 27, 2007 fell on a Sunday, and Monday, May 28, 2007, was a federal holiday (Memorial day), this REPLY BRIEF, which is being submitted on Tuesday, May 29, 2007, should be deemed to have been filed within two months of the March 27, 2007 mailing date of Examiner's Answer in the above-referenced appeal. 37 C.F.R. § 1.7.

(VII) ARGUMENT

(B) ART RELIED UPON

Morita

Morita discloses several embodiments of STI structures, most of which include a central region of silicon nitrogen film 37 that fills a trench 2. The only embodiment of an STI structure that includes an integral laterally extending ledge is shown in FIG. 72. More specifically, FIG. 72 of Morita shows an intermediate semiconductor device structure that includes a semiconductor substrate 1 with at least one trench 2 formed therein, silicon oxide films 11 and 36 lining the active surface of the semiconductor substrate 1 and the surfaces of the trench 2, respectively, and silicon nitrogen 37 filling the remainder of the trench 2. *See also*, col. 13, lines 19-26. The silicon oxide film 11 prevents the silicon nitrogen 37 from contacting any portion of the semiconductor substrate 1; the silicon nitrogen 37 instead contacts the silicon oxide film 11 that lines the trench 2 and regions of the active surface of the semiconductor substrate 1 that are adjacent to the trench 2. *See id.*

Mandelman

Mandelman describes (at col. 5, lines 3-23) and illustrates (in FIG. 4c) a precursor to a semiconductor device structure that includes a semiconductor substrate 10 with trenches 16 formed therein. The trenches 16 of the semiconductor substrate 10 are lined with a thermal oxide 34, as are areas of the active surface of the semiconductor substrate 10 that are located adjacent to the trenches 16. FIG. 4c; col. 5, lines 3-23. STI structures 18 fill the remaining space within the trenches, and include corner dielectrics 22c that extend laterally over regions of the

active surface of the semiconductor substrate 10 that are located adjacent to the trenches 16. *Id.*

The thermal oxide 34 prevents the STI structures 18a and their corner dielectrics 22c from contacting any portion of the semiconductor substrate 10; the STI structures 18a and their corner dielectrics 22c instead contact the thermal oxide 34 that lines the trenches 16 and regions of the active surface of the semiconductor substrate 10 that are adjacent to the trenches 16. *Id.*

(C) ANALYSIS

(1) MORITA

Claims 1-4, 6, 13, 18, 19, 21, 23, and 24 have been rejected under 35 U.S.C. § 102(b) for reciting subject matter which is purportedly anticipated by that described in Morita.

It has been asserted in the Examiner's Answer that "the term 'structure' is commonly defined as an arrangement of parts in a body and as such does not preclude portions being formed at separate times or of different materials." *See* Examiner's Answer, page 4. It has been asserted that Morita describes a single structure formed in a groove 2 in a substrate 1. The purported "structure" of Morita includes a silicon dioxide film 11 and a silicon nitride film 37 fabricated separately from one another and from different materials: "the film 3(37) and the portion of the film 11 under 3(37) are two portions of a trench structure." *Id.* The silicon nitride film 3(37) contacts a surface of the silicon oxide layer 11, which, in turn, contacts a surface of the substrate 1. Assuming, for the sake of argument, that one skilled in the art would consider the silicon oxide film 11 of Morita to be part of the shallow trench isolation structure 3(37), which Applicant does not concede due to the presence of a discernable boundary between the silicon oxide film 11 and the silicon nitride film 3(37), the shallow trench isolation structure 3(37)

would extend well beyond portions of the active surface adjacent to the trench 2. Thus, Morita lacks any express or inherent description of a trench isolation structure that only contacts the portion of an active surface adjacent to the trench.

The Examiner has also argued that “the portion of layer 11 not under 3(37) is not part of the isolation structure.” Examiner’s Answer, page 4. The Examiner further asserts that “although there is a discernable boundary between layers 11 and 3(37), both layers are part of the trench isolation structure and both layers are part of the ledge.” *Id.*

Despite the lack of a discernable boundary within the silicon oxide film 11, the Examiner does not consider the entire silicon oxide film 11 to be part of the “structure.” However, Figure 72 of Morita clearly shows that the silicon oxide film 11 is a single, integral layer without boundaries at the edge of the trench isolation structure 3(37). Furthermore, nothing in Morita describes the silicon oxide trench 2 as having boundaries such as those delineated by the Examiner. Thus, it is unclear what reasoning has lead the Examiner to conclude that certain portions of the silicon oxide film 11 are part of the shallow trench isolation structure 3(37), while other portions of the same silicon oxide film 11 are part of a separate structure or, more broadly, how the Examiner could redefine the term “structure” to include an arrangement of selected parts of some elements (*e.g.*, the silicon oxide film 11) and all of other elements (*e.g.*, the silicon nitride film 3(37)). Thus, in the process of determining whether the silicon oxide film 11 and the silicon nitride film 3(37) of Morita are a “structure,” more emphasis has been improperly placed on an undiscernable, arbitrarily positioned boundary within the silicon oxide film 11 than on the readily discernable boundary between the silicon oxide film 11 and the silicon nitride film 3(37).

It is respectfully submitted that a more accurate interpretation of the subject matter described in Morita is that the silicon oxide film 11 and the silicon nitride film 37 are separate structures. As such, it is respectfully submitted that, for reasons that have already been presented in the above-referenced appeal, Morita does not anticipate the subject matter recited in any of independent claims 1, 13, or 18, as would be required to uphold the 35 U.S.C. § 102(b) rejections of these claims.

Claims 2-4 and 6 are each allowable, among other reasons, for depending directly or indirectly from independent claim 1, which is allowable.

Each of claims 19, 21, 23, and 24 is allowable, among other reasons, for depending directly or indirectly from independent claim 18, which is allowable.

(2) MANDELMAN

Claims 1-4, 6, 13, 18, 19, 21, 23, and 24 have each been rejected under 35 U.S.C. § 102(b) for being drawn to subject matter that is allegedly anticipated by the subject matter described in Mandelman.

With respect to the subject matter shown in FIG. 4c of Mandelman, the Examiner asserts that “the film 34 and 18a are two portions of a trench structure that serve[s] the function of device isolation and are therefor[e] encompassed by the term ‘trench isolation structure.’” Examiner’s Answer, page 5. However, the STI structure 18 and thermal oxide layer 34 described in Mandelman are fabricated separately from one another and from different materials. Because the thermal oxide layer 34 and the STI structure 18 comprise different materials, they should also be considered to be different structures. Thus, the corner dielectric 22c of the STI structure 18

does not contact the active surface of the substrate 10. Rather, the corner dielectric 22c of STI structure 18 contacts the discernably distinct thermal oxide layer 34. As such, Mandelman does not anticipate a shallow trench isolation structure with an integral ledge that contacts an area of an active surface of a semiconductor substrate adjacent to at least one trench, as required by each of independent claims 1, 13, and 18.

Additionally, the manner in which the oxide layer 34 and STI structure 18 of Mandelman are formed results in a discernable boundary between these elements, contrary to the requirement of independent claims 1 and 18 that there be no discernable boundary between a ledge of a shallow trench isolation structure and the remainder of the shallow trench isolation structure.

As such, Mandelman does not anticipate each and every element of any of independent claim 1, independent claim 13, or independent claim 18, as would be required to maintain the 35 U.S.C. § 102(b) rejections of these claims.

Claims 2-4 and 6 are each allowable, among other reasons, for depending directly or indirectly from independent claim 1, which is allowable.

Each of claims 19, 21, 23, and 24 is allowable, among other reasons, for depending directly or indirectly from independent claim 18, which is allowable.

In view of the foregoing, reversal of the 35 U.S.C. § 102(b) rejections of independent claims 1, 13, 18 and the claims that depend therefrom is respectfully solicited.

(XI) CONCLUSION

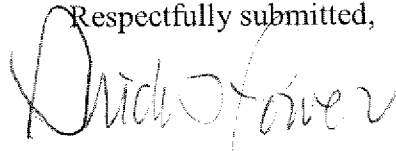
It is respectfully submitted that:

(A) Claims 1-4, 6, 13, 18, 19, 21, 23, and 24 are allowable under 35 U.S.C. § 102(b) for reciting subject matter which is patentable over that described in Mandelman; and

(B) Claims 1-4, 6, 13, 18, 19, 21, 23, and 24 are also allowable under 35 U.S.C. § 102(b) for being directed to subject matter that is novel over the subject matter described in Morita.

Accordingly, it is respectfully requested that the rejections of claims 1-6, 13, 14, and 18-24 be reversed and that each of these claims be allowed.

Respectfully submitted,



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